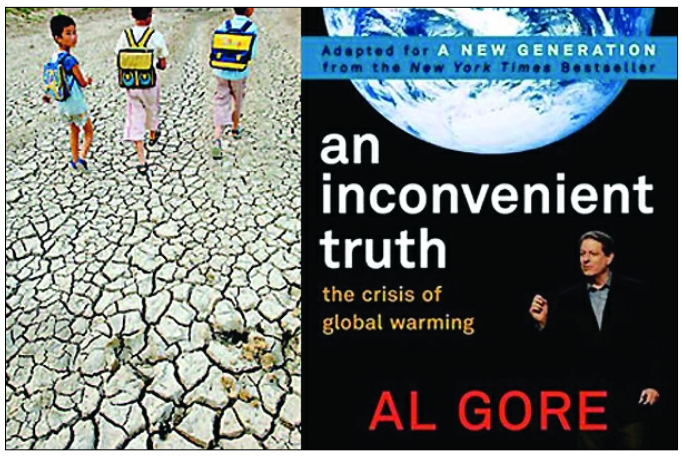
Tracking down global warming

Evidence from natural records can clinch the case, says **S Ananthanarayanan**



THE severe winter that the world just went through has spurred the doubters of global warming to another burst of denial. How could you have sustained such cold conditions in a warming world? It was the coldest winter in over a decade — what does common sense make of that? Are things warming up or cooling down?

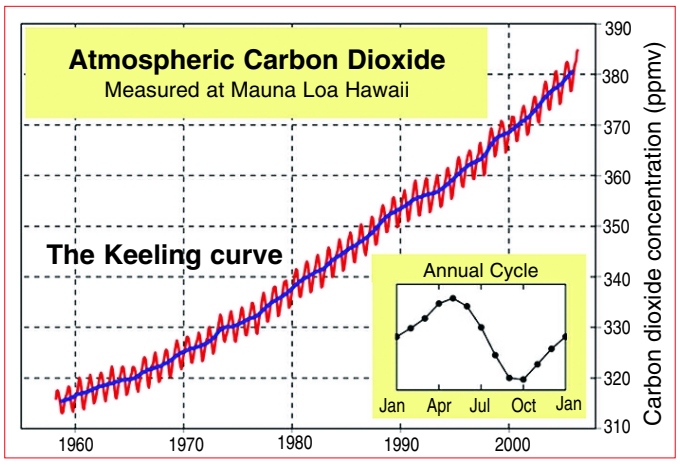
The journal *Science* carries a paper by Christian Körner and David Basler of the Institute of Botany in Basel, Switzerland, that describes how the flowering cycle of plants and flowers has changed in recent times as clear, unmotivated proof that the climate is changing.

Inconvenient truth

Former US Vice-President Al Gore's film provided the first collected, publicly presented evidence that the world was warming. Gore relied on hard, documented evidence of warming, its catastrophic potential and, most important, that the warming was *man-made*.

The case was developed using five main factual bases, namely:

- Charles David Keeling's formal, meticulous record of atmospheric carbon dioxide since 1958: while the level of carbon dioxide varies cyclically both during the day and during the year, Keeling's record shows that the up-down curve itself has been moving up and up these last 50 years, from an average 315 parts per million to 385 parts per million.
- Photographs of glaciers: Gore's film has dramatic pictures of glaciers taken a few years apart that show a marked shrinking of the ice and the retreat of glaciers to higher reaches.
- Ice core data to measure CO_2 levels: researchers have studied ancient ice buried deep in the Antarctic to measure CO_2 levels in past periods. The study shows that the present levels are the highest since 6,50,000 years ago.
- A section of the US department of commerce has collected records of land and sea temperatures since 1880 that show that 1997-2008 contain the 10 hottest years.
- A survey of scientific thought to show that most informed scientists did agree that there was significant warming caused by human activity.




Charles David Keeling

Doubters

But there is no dearth of skeptics who believe or profess that talk of global warming is an unfounded scare. They question and rubbish the evidence and present the global warming spectre as one more horror tale concocted by the science community — "… all it will do is to push up the price of oil, and everything else, to contain emissions…"

To add grist to their mill was the recent *Glaciergate error*, when UN climate researchers admitted to a blunder in their findings. The climate pundits had estimated that Himalayan glaciers would disappear by 2035, but they admitted that the estimate was wrong, it would take much longer — as much as 300 years. The skeptics pounced on the admission and went on to discount the entire report.

A hard winter, doubts about the value of scientific evidence and evidence based on records kept by geeks in laboratories, experiments in remote Antarctic ice cores, which somehow seem removed from experience, do encourage "confidence in the future" and give people *permission* to carry on with the comfortable style of driving fast cars, running airconditioners and to seek development, which pushes up the generation and consumption of power.

Phenology

The events of germination, sprouting, flowering of plants, or the growth and reproductive cycle of insects take place according to the change of seasons. Phenology is the study of how these life cycle events are affected by changes in climate, from season to season or over the years. Because the timings are found to be very sensitive in their response, phenology is seen as a powerful resource for uncovering convincing evidence of environmental warming.

In 2007, the journal *Current Biology* carried a paper by researchers from Denmark that reported, "In the earth's cold and icy far north, the harsh winters are giving way to spring weeks earlier than they did just a decade ago." According to the researchers, "The finding in the Arctic, where the effects of global warming are expected to be most severe, offers an 'early warning' of things to come on the rest of the planet.."

To uncover the effects of warming, the researchers looked at the timing of familiar signs of spring seen in plants, butterflies, birds and other species. Shifts in phenology, or the timing of these events, are considered one of the clearest and most rapid signals of biological response to rising temperatures, Dr Toke T Hø ye, one of the researchers, explained.

Using the most comprehensive data set available for the region, the researchers documented that the flowering dates in six plant species, the median emergence dates of 12 arthropod species and clutch initiation dates in three species of birds had advanced, in some cases by over 30 days during the last decade, the average across all time series being 14.5 days per decade.

The latest article, *Plant science, phenology under global warming*, by Christian Körner and David Basler of Basel, traces the latest findings and says, "Phenological events such as bud burst, flowering and senescence have received increased interest in the light of global warming. Spring events at temperate latitudes have advanced by 2.5 days per decade since 1971. As global warming progresses, how will it affect the arrival of spring and the length of the growing season?"

At the same time, the journal *Nature* announces an international, multidisciplinary conference on Phenology which would bring together experts on phenology from both terrestrial and aquatic ecosystems in Dublin in June 2010.

The mounting phenological evidence of global warming will help turn the scale in attaining results in emission limit negotiations.

The writer can be contacted at simplescience@gmail.com

External factors

The synthetic tracks that have been developed over the years certainly help athletes move faster. If you're running into a strong wind you're going to be slower, while having the wind behind you would help.

Temperature is also important. As you increase the temperature of muscles they are able to generate more speed, so most records are broken on warm, still days. Altitude can help for sprinting, as there's less air resistance.

Manufactures have experimented with clothing. Australian sprinter Cathy Freeman had a body suit with a hood to reduce air resistance, letting the air flow over the body easily. Most running shoes are custom-made and very, very light. There have been advances in design, and these may continue to help people improve.

Chemical and genetic advancements

Anabolic steroids and other drugs do give an advantage. There are medical and health issues, but they could improve performance — that's why they're banned! As far as I know, there's never been anything written where an athlete experiments to see just how fast he/she could go with steroids, so we don't know exactly what difference they could make.

A lot of people are looking at the area of genetic development to increase speed, particularly muscle development and muscle recovery. But at the moment we don't know enough about the improvements training, technology and nutrition can have, so looking at gene therapy is perhaps getting ahead.

Why don't humans run faster?

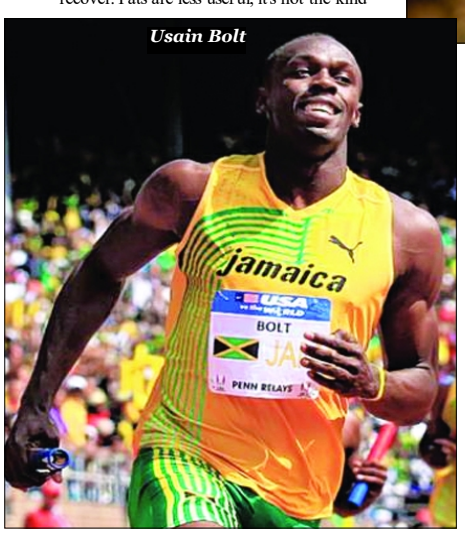
Evolutionarily, humans were hunter-gatherers, so it wasn't just a question of speed. Compared to animals, especially with four legs, we are quite slow. We have some speed, although not much if you compare us to a cheetah or even dogs. But then we also have a capacity for endurance, to hunt over days. Now we have more sedentary lifestyles, so sport is what allows members of our society to push these speed limits. In some ways, athletes are representing us as a species in developing our speed.

The Independent, London

Under the microscope

How fast can a human run?
Holly Williams gets the answers from Professor Craig Williams, School of Sport and Health Sciences, University of Exeter


Craig Williams



Usain Bolt

RESEARCHERS think 30 miles per hour could be the human limit. Most use the 100 metres to calculate how fast we can run. The current record for the 100 metres is 9.58 seconds, by Usain Bolt in 2009. That gives a speed of 23.3 mph. But interestingly, during the 60-80 metres stretch of the race Bolt averaged a speed of 27.8 mph.

However, as distinguished physicist Neils Bohr said, "Prediction is very difficult, especially if it is about the future." Many commentators previously suggested under 10 seconds was unbreakable; now Bolt's coach is aiming for 9.4 seconds. The 100 metres record now held by a woman would have beaten the fastest male back in the 1950s.

How to run fast

A key thing is the use of the chemical energy Adenosine Triphosphate (ATP) in our muscles. This fuels them to contract, to move the various joints in our legs, to forcefully hit the ground and turn that energy into speed. For sprinting, having fast-twitch muscle fibres, which quickly translate energy into force, gives you an advantage.

Obviously it's not just about legs. You're driving your arms backwards and forwards. Your trunk area is important — you have to hold your body upright. Coaches will talk about keeping the head steady too.

To improve speed, you train with a combination of sprint drills, technical drills, weight training, rest and recovery. In diet, there's an accent on carbohydrates and protein, which help you to exercise and to recover. Fats are less useful; it's not the kind of energy that can be converted quickly.

Body type for speed

The importance of body shape is a difficult one. Bolt is unusually tall, at six feet and five inches, whereas most sprinters are around five feet 11 inches. But we do know athletes are getting taller and heavier: over the last 100 years elite athletes increased in height by 16 centimetres, compared to five centimetres in the general population.

Generally, sprinters will have a musculature that is fast-twitch fibre-based. Everybody has a percentage of fast and slow twitch muscles, genetically laid down, although some can be promoted by training. There's very little data on fibres of elite athletes because it requires a quite invasive procedure: a needle puncture into a muscle to snip out a bit the size of a rice grain.

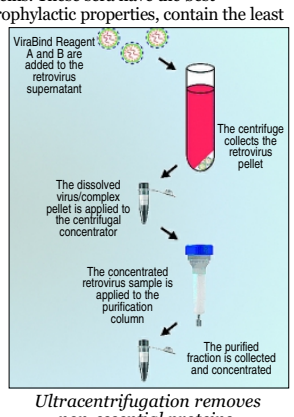
Healing touch

Tapan Kumar Maitra explains the practical importance of immunity reactions

SERA are injected in definite doses intramuscularly, subcutaneously — sometimes intravenously — with strict observation of all the rules of asepsis. A preliminary desensitisation, according to Bezredka's method, is necessary.

Sera are employed for treatment and for prophylaxis of tetanus, gas gangrene and botulism. The earlier the serum is injected, the more marked is its therapeutic and prophylactic action. The length of protective action of sera (passive immunity) is eight to 14 days.

At present many institutes of vaccines and sera in Russia produce purified therapeutic and prophylactic stuff. They are treated by precipitating globulins with ammonium sulphate and fractionation, by the method of ultracentrifugation, electrophoresis and enzymatic hydrolysis that allow the removal of up to 80 per cent of non-essential proteins. These sera have the best therapeutic and prophylactic properties, contain the least amount of unrequired proteins, and have a less distinct toxic and allergic action.



Ultracentrifugation removes non-essential proteins.

Sera thus produced are subdivided into anti-toxic and anti-microbial sera. Anti-toxic sera include anti-diphtheritic, anti-tetanic sera and those effective against botulism, anaerobic infections and snake bite.

Anti-microbial sera are used against anthrax, encephalitis and influenza in the form of globulins and gamma globulins.

The latter are used for prophylactic purposes against measles, poliomyelitis, whooping cough, virus hepatitis and smallpox. Gamma globulin is used together with vaccine against rabies. They are completely harmless preparations and do not contain the virus of Hepatitis B or causative agents of other diseases.

Specific gamma globulins with a directed effect have been recently produced. These are obtained from donors immunised against the given infection. Such globulins contain a higher titre of anti-bodies. The Cytotoxic anti-reticular serum, as suggested by A Bogomolets, is now used with a favourable therapeutic effect to stimulate the functions of organs; intensify immunogenesis and leucocyte phagocytic activity; promote healing of wounds, ulcers and fractures; increase resistance to malignant growth; and promote restoration of the leucocyte count in leucopenia caused by irradiation. It is also used in cases with diminished reactivity and resistance due to inhibited activity of the connective tissue system.

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First fruits

M Sreelata reports on an open source TB megaproject


The project used online tools to map the 4,000 genes of M. tuberculosis

A UNIQUE effort by scientists to pull together scattered genetic information about the tuberculosis (TB) bug, with the goal of developing new remedies, has identified its first candidate molecule. The Open Source Drug Discovery programme aroused huge interest when it was mooted by Samir Brahmachari, director-general of India's Council of Scientific and Industrial Research, in 2007 because it offered a new route to finding drugs for diseases in the developing world traditionally neglected by drug companies.

The CSIR launched the programme in September 2008. Its research is conducted through collaboration and open source information, guaranteeing, it is hoped, that any drug developed from the process will be affordable. Brahmachari announced recently that one of the first projects undertaken under the initiative — "Connect to Decode" or C2D — to pool all available genetic and biological information on *Mycobacterium tuberculosis* had yielded the first tangible results.

He said that for the first time TB scientists, research students and five private companies had used online tools to combine their work to show the links between the 4,000 genes of *M. tuberculosis* and the proteins for which they code. The work is held in a shared database that the OSDD will share through its open portal.

"This is the first time that a comprehensive mapping of the *M. tuberculosis* genome has been compiled, verified and made publicly available. C2D's findings may contain critical data to unlock previously undiscovered details of tuberculosis resulting in development opportunities for urgently needed new TB drugs in India and other developing countries,'" Brahmachari said.

The project has already yielded a molecule that could form the basis for a drug to fight TB. Rajesh Gokhale, director of India's Institute of Genomics and Integrated Biology, and his team have given the molecule to pharmaceutical company Jubilant Chemsys for development. Five private pharmaceutical companies have so far joined the OSDD programme — Jubilant Chemsys, TCG Lifesciences, Sugen Life Sciences, Premas Biotech and Vimta Labs.

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